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5≡ Name of Invention: COLORED RESIN COMPOSITION AND MOLDED ARTICLE OF THE SAME
5& [Problem To Be Solved] To obtain a molded article having high pigment dispersibility while sufficiently suppressing the plate-out of pigment.

[Means To Solve the Problem] The molded article can be obtained by using a colored resin composition containing a styrene-based resin, a pigment, a fatty acid amide and a specific amount of metallic soap.

[Scope of Patent Applied]

[Applied Item 1] A colored resin composition with containing a styrene-based resin, a pigment, a fatty acid amide and a metallic soaps, the metallic soap being 0.0001 ~ 5 wt.% of the pigment and the weight ratio between the metallic soap and the fatty acid amide as 10 ~ 50/ 90~ 50.

[Applied Item 2] A colored resin composition, whose fatty acid amide is an ethylenebisstearamide and consists of 0.0001 ~ 15 wt.% of the pigment as described in the Applied Item 1 above.

[Applied Item 3] A colored resin composition, with one or more metallic soaps selected from either stearic acid lithium or stearic acid magnesium as described in the Applied Item 1 or 2 above.

[Applied Item 4] A colored resin composition, whose pigment is inorganic or carbon black and fits the description in the Applied Item 1 or 3 above.

[Applied Item 5] A colored resin composition, whose styrene resin is selected from one or more of the following: ABS resin, AAS resin and AES resin as described in Applied Item 1 or 4.

[Applied Item 6] A molded article consisting of colored resin composition as described in Applied Item 1 or 5.

[Detailed Description of Invention]

[0001]

[Applicable Field of Industry] This invention relates to a colored resin composition (a master batch) and its molded article which is superior in suppressing the plate-out of the pigment, having high dispersibility and capable of preventing its exudation to the molded article's surface and also to the interfacial side of the mold and the melted resin.

[0002]

[Traditional Techniques] In order to avoid the pigment discoloration during the molding because of its heat history, inorganic pigments or carbon blacks have often been used in coloring heat plasticizing resins. Although these pigments were better for coverage than their organic counterparts, they failed to provide adequate color. For example, if a styrene resin was needed to obtain the desired color, a large amount of pigment had to be used to achieve the satisfactory result especially in case of ABS resins, whose original color happens to be yellow.

[0003] Traditionally speaking, dispersing agents or processing aids, including metallic soap, hydrocarbon waxes and fatty acid esters were used to ensure even distribution of the coloring pigment into the desired resin compositions. However, in order to evenly disperse a large amount of coloring pigments, such agents and aids had to be used in a large volume. Consequently, when the finished colored resin compositions were put through extrusion molding, it damaged the appearance of the molded compositions. This was a result of leaching occurred inside the cylinders or dyelips of the molds, either in powder or liquid form, altering the outer appearance of the compositions, potentially resulting in defective products. This phenomenon has been called "plate-out", and interfered with the appearance of long-run molding of molded articles.

[0004] Defective appearance is a serious damage when it comes to molded resin articles, and damaged-looking articles have to be disposed of even if they are mechanically satisfactory. To

reduce the plate-out, steps were taken, including shortening the continuous molding time, increasing the frequency of cleansing inside the molds and wiping off the leaching as a post-production process. However, such efforts caused lower productivity and increased number of defective articles, eventually leading to the increase of the molded articles.

[0005] Recent cost reduction of molded articles came to demand a higher content of pigments in colored resin compositions and higher concentration as well, which has made it urgent to achieve higher dispersibility and to find solutions for the plate-out problem.

[0006]

[Problem To Be Solved By This Invention] The purpose of this invention is to obtain better quality colored resin compositions, which would not cause leaching inside the molds, but would produce molded articles with a fine appearance.

[0007]

[Means To Solve the Problem] The first item of this invention, [Applied Item 1], is a colored resin composition containing styrene resin, coloring pigments, fatty acid amide and metallic soap. Its features are the mixing ratio of the metallic soap being 0.0001 ~ 5 wt.% of the pigment as well as the weight ratio of metallic soap/fatty acid amide being 10 ~ 50/90 ~ 50.

[0008] The second item of this invention, [Applied Item 2], is that the fatty acid amide is ethylenebisstearamide. It is a colored resin composition described as the first item of this invention, which is 0.0001 ~ 15 wt. %

[0009] The third item of this invention, [Applied Item 3], is the colored resin composition described in Items 1 and 2 above, whose metallic soaps will be selected from stearic acid lithium and/or stearic acid magnesium.

[0010] The fourth item of this invention, [Applied Item 4], is the colored resin composition which uses inorganic pigments or carbon black as described in Item 1 or 3 above.

[0011] The fifth item of this invention, [Applied Item 5], is a colored resin composition described in Item 1 or 4 above, whose one or more styrene resins are selected from ABS resin, AAS resin and AES resin.

[0012] The sixth item of this invention, [Applied Item 6], is a molded article made from the colored resin compositions described in Item 1 or 5 above.

[0013]

[Conditions for Using this Invention] The fatty acid amide used as the dispersing agent for this invention's colored resin composition can be a primary amide, such as stearic acid amide, oleic acid amide, erucic acid amide; secondary amide such as N-oleyl stearic acid amide, N-stearoyl erucic acid amide or bisamides, such as N, N'-methylenbisstearamide and N, N'-ethylenebisstearamide. Among the fatty acid amides sold on the market as industrial ingredients N, N'-ethylenebisstearamide is most ideal.

[0014] The fatty acid amide is preferred to be 0.0001 ~ 15 wt.% of the colored resin composition's pigment.

[0015] Once the fatty acid amide is added to the colored resin composition, it will have a good advantage in suppressing the plate-out, but it may not have good dispersibility for the pigment depending on the contents of the colored resin composition. However, adding a specific amount of metallic soap can solve this problem.

[0016] The metallic soap used for this invention is a metallic salt of a saturated fatty acid whose carbon number is 12 ~ 22. The list of saturated fatty acids include lauric acid, stearic acid, 12-hydroxystearic acid, behenic acid and glyceride, but stearic acid is the best one to choose. Although calcium, aluminium, lithium and magnesium can be listed as the main metals, lithium and magnesium are most appropriate. One or more can be chosen and used at the same time.

[0017] It has been known that adding metallic soap to the colored resin composition triggers plate-out. However, when a specific amount of metallic soap is added, together with a fatty acid amide listed above, not only can the plate-out be prevented but also dispersibility for pigment can be improved, compared to having a fatty acid alone, and, as a result, the composition's workability will be improved substantially.

[0018] As for the metallic soap, it should be 0.0001 ~ 5 wt.% of the pigment in the colored resin composition. If it is less than 0.0001 wt.%, good dispersibility for pigment cannot be expected. And if it is more than 5 wt.%, plate-out becomes a serious concern. Furthermore, the preferred weight ratio of metallic soap/fatty acid amide is 10 ~ 50/ 90 ~ 50 but 20 ~ 35/80 ~ 65 is the ideal range. If this ratio is not followed, it is very difficult to control the plate-out or to achieve dispersibility for the pigment.

[0019] When it comes to coloring pigments, this invention requires commonly known pigments including azo, phthalocyanine, aniline black, indigo, dioxadene, quinacredon, isoindoline and such organic pigments, while titanium oxide, zinc sulfide ultramarine blue, navy blue, titanium yellow containing chrome and antimony, iron oxide red and iron black are considered inorganic pigments along with carbon black. Especially in this invention, inorganic pigments can do a wonderful job when used in a large quantity, because their staining power is not so strong and it needs to be compensated by using a large amount. The blending and/or weight ratio of these pigments can be adjusted depending on the desired color of molded articles.

[0020] Styrene resins used in this invention include AS (Acrylonitrile-Styrene) resin, ABS (Acrylonitrile-Butadiene-Styrene) resin, AAS (Acrylonitrile-Acrylic-rubber-Styrene) resin and AES (Acrylonitrile-(ethylene-propylene)-styrene) but wax is not added.

[0021] It is quite acceptable to add to styrene resins, a copolymer made of acrylonitrile and styrene, at the weight ratio of acrylonitrile/styrene = 90 ~ 50/10 ~ 50. If a ABS resin is used, it can be polybutadiene, a copolymer of styrene and butadiene or even a copolymer of butadiene and acrylonitrile. If an AAS resin is used, the addition can be acrylic rubber. If an AES resin is used, ethylene-propylene rubber can be mixed at a certain ratio and blended into the resin.

[0022] In this invention 'resin' refers to a composition based on the JIS K7210 standards, which MI measurement can be applied to, and 'wax' refers to something that cannot be measured by MI.

[0023] It is preferred that the styrene resin be 15 ~ 99.99 wt.% of the entire colored resin composition. There are risks that coloring of the molded article or the properties can be impaired

when the mixing ratio is not within the set range, and a good quality colored resin composition cannot be obtained.

[0024] According to this invention, the colored resin composition can be obtained by pouring the mixture of the coloring pigment, a fatty acid amide, and metallic soap into a kneading machine together with a styrene resin. After fusing and kneading the mixture, it comes out as a powder, beads or in pellets.

[0025] Several types of kneading machines are available including a rotating type such as a Banbury mixer, a double-shaft type or a double-shaft rotor type, and there is no specific preference. Kneading temperature may change depending on the ingredients but 150 ~ 280°C is the preferred range. When the temperature is lower than 150°C, the mechanical load may become too large, and the workability can be compromised. Should the temperature be more than 280 °C, the ingredients may decompose.

[0026] This invention's colored resin composition contains a large amount of coloring pigment, and will be thinned by a diluted resin (thermal plasticizing resin, not colored) and handed over to the molding machine as a master batch. Any kind of diluted resin may be selected as long as it has the compatibility with the colored resin composition.

[0027] It is preferred, in the molded article, that the ratio of the colored resin composition and the diluted resin be 1 ~ 30/99 ~ 70. If the ratio is out of this range, there is a chance that the color or properties of the molded article can become defective. Molded articles are synthetic resin products, many of which are used for household electronic appliances.

[0028] Colored resin compositions or molded articles may contain one or more of the following to prevent discoloration of the resin and to retain their mechanical properties, if it is considered necessary, and as long as it can suppress the plate-out: phenol, phosphorus or sulfur antioxidant, coloring pigments such as talc or aluminum particles, to achieve unique designs. They may also use additives including UV ray absorbent or surface active agents.

[0029] As there is a tendency for hydrocarbon wax and/or fatty acid esters other than the fatty acid amide to aggravate the plate-out, those additives are best kept no more than 3wt.%, ideally less than 1wt.%

[0030]

[Example] For the purpose of explaining this invention in more detail, test samples and comparative samples are shown in the following, but this invention is not limited to the following results alone. Numbers in charts indicate wt.%

[0031] (Examples 1 ~ 5) Composed mixtures were poured into a double-shaft extruding machine. The thermal kneading was done at 230°C and colored resin compositions were produced.

[0032] After the above process the colored resin composition was mixed with ABS resin chosen as the diluent at the wt.% ratio of 50/50. The mixture was poured into a T-dye sheet extrusion molding machine and using full flight screws ϕ 30mm (L/D=20), set temperature at 230°C, a T-dye sheet was produced, which was 1.5cm wide, 30cm long and 1mm thick. It should be noted that this was a testing sample made with excess amount of colored resin composition to

aggravate the plate-out, which became visible in a shorter time than with regular molded articles. The plate-out on this T-dye sheet, the plate-out particles inside the dice head of the T-dye sheet extrusion molding machine, and the dispersibility for the pigment were observed by human eye and evaluated as given in Chart-1 below.

[0033]

(Classification of Plate-out Resistance)

◎ Plate-out was not at all visible.

○: Plate-out somewhat visible but good enough for standard use.

X: Plate-out was found.

(Classification of Pigment Dispersibility on T-dye Sheet)

◎: Lumps could not be found.

○: Some lumps found, but good enough for standard use.

X: Lumps visible.

[0034]

[Chart 1]

Test Sample No. Colored Resin Composition		1	2	3	4	5
ABS Resin		64	63	63	59	59
Titanium Oxide		30	30	30	30	30
Carbon Black		2	2	2	2	2
N,N'-Ethylenebissteramide		3	4	4	4	4
Stearic Magnesium		1	1	—	4	4
Stearic Lithium		—	—	1	—	—
Polyethylene Wax		—	—	—	1	—
Tetraalcohol Stearic Acid Ester		—	—	—	—	1
Plate-out	T-dye Sheet	◎	◎	◎	○	○
Evaluation	T-dye Sheet Molder	◎	◎	◎	○	○
Color Pigment Dispersibility on T-dye Sheet		◎	◎	◎	○	◎

[0035] (Comparative Sample 1 ~ 5)

Composed mixtures were poured into a double-shaft extruding machine as described in the Examples 1 ~ 5 above, and colored resin compositions were made after thermal kneading. A T-dye sheet was made as was done in Example 1, and test results are given in Chart 2.

[0036]

[Chart-2]

Comparison No. Colored Resin Composition		1	2	3	4	5
ABS Resin		67	64	62	62	60
Titanium Oxide		30	30	30	30	30
Carbon Black		2	2	2	2	2
N,N'-Ethylenebisstearamide		1	1	1	1	3
Stearic Magnesium		-	3	5	4	4
Stearic Lithium		-	-	-	1	-
Polyethylene Wax		-	-	-	-	1
Plate-out Evaluation	T-dye Sheet	⊙	⊙	X	X	X
	T-dye Sheet Molder	⊙	X	X	X	X
Color Pigment Dispersibility on T-dye Sheet		X	⊙	⊙	○	○

[0037]

[Effects of This Invention] By using a styrene-based resin, a coloring pigment, a fatty acid amide and a specific amount of metallic soap based on this invention, it was possible to achieve high dispersibility of coloring pigments and to suppress the plate in molding an article.

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